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Attachment to Amendment

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# McGRAW-HILL CONCISE ENCYCLOPEDIA OF SCIENCE & TECHNOLOGY

Second Edition

**Sybil P. Parker**

Editor in Chief

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On the cover: The Great Nebula in Orion is a gas cloud excited to incandescence by hot stars in its center. The photograph was made with a 150-in. (3.8-m) telescope. (Copyright by Anglo-Australian Telescope Board, 1981)

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analysis) and determine (quantitative analysis) metals and some nonmetals. Under optimum conditions, as little as  $10^{-10}$  gram of an element per gram of sample can be determined.

The steps in emission spectrochemical analysis are: vaporization and atomization of sample; excitation of atomic vapor; resolution of emitted radiation; and observation and measurement of resolved radiation. See SPECTROSCOPY. [A.T.Z.]

**Emissivity** The ratio of the radiation intensity of a non-blackbody to the radiation intensity of a blackbody. This ratio, which is usually designated by the Greek letter  $\epsilon$ , is always less than or just equal to one. The emissivity characterizes the radiation or absorption quality of nonblackbodies. Published values are readily available for most substances. Emissivities vary with temperature and also vary throughout the spectrum. For an extended discussion of blackbody radiation and related information see HEAT RADIATION. [H.G.S.; P.J.W.]

**Emitter follower** A circuit that utilizes a common-collector transistor which provides less than unity voltage gain but high input resistance and low output resistance. This circuit is used extensively to provide isolation or impedance matching between two electronic circuits.

The most common use for the emitter follower is as a device which performs the function of impedance transformation over a wide range of frequencies with voltage gain close to unity. In addition, the emitter follower increases the power level of the signal. [C.C.H.]

**Emotion** An umbrella concept in the common language, typically defined by instantiation by reference to a variety of mental and behavioral states. These range from lust to a sense of liking, from joy to hostile aggression, and from esthetic appreciation to disgust. Emotions are usually considered to be accompanied by some degree of internal, frequently visceral, excitement, as well as strong evaluative components. Emotions are also often described as irrational, that is, not subject to deliberative cognition, and as interfering with normal thought processes.

These latter qualities are often exacerbated in the emotional behavior and expression seen in clinical cases. The expression of strong emotions is typically considered to be symptomatic of some underlying conflict, and even the positive emotions are used as indices of unusually strong attachments and atypical earlier experiences. Sigmund Freud introduced the concept of repression to describe a defense mechanism against the occurrence of strong emotional experiences. From the psychoanalytic point of view, what is repressed is not the emotion itself, since the very concept of emotion implies conscious experience, but rather the memory of an event which, if it became conscious, would lead to strong conflicts and emotional consequences. Many other defense mechanisms, such as rationalization and compulsive or obsessive neurotic symptoms, are also seen as serving the purpose of avoiding conscious conflict and emotional sequelae. See NEUROSIS; PSYCHOANALYSIS. [G.M.]

**Emphysema** A disorder of pulmonary inflation characterized by enlargement and destruction of the air spaces. The key element in this definition is the word destruction for it implies the irreversible loss of a given area of the pulmonary parenchyma. Certain variants of this condition do not necessarily imply irreparable destruction of pulmonary tissue but rather overdistension of air spaces, and consequently are not properly classified as emphysema.

Generalized emphysema probably has many causes; most share chronic bronchitis as a factor. Narrowing at this level would cause retention of air, leading to dilatation and rupture of alveolar septa. Increasing attention is being given to heavy cigarette smoking and air pollution as contributing factors.

Given the dilatation of the air spaces, the total air space in the lungs is increased. However, the lungs cannot be properly emptied and are functionally impaired.

Emphysema, if widespread, will cause very serious limitation in physical activity. Many cases, however, are compatible with long survival. Complications of severe emphysema include right heart failure (cor pulmonale), respiratory acidosis, and rupture of bullae with development of pneumothorax.

The important variants of emphysema are as follows. Centrilobular emphysema affects predominantly respiratory bronchioles without involvement of the more peripheral elements. In diffuse vesicular emphysema, the most common form, all elements of the respiratory unit (respiratory bronchiole, alveolar ducts, alveolar sacs, and alveoli) are dilated. Senile emphysema was formerly applied to barrel-chested elderly people; however, functional impairment is, in most cases, inconspicuous. This condition is also known as aging lung. (See BRONCHIAL DISORDERS. [V.E.G.]

**Empirical method** The empirical method is generally characterized by the collection of a large amount of data before much speculation as to their significance, or without much idea of what to expect, and is to be contrasted with more theoretical methods in which the collection of empirical data is guided largely by preliminary theoretical exploration of what to expect. The empirical method is necessary in entering hitherto completely unexplored fields and becomes increasingly less purely empirical as the greater is the acquired mastery of the field. Successful use of an exclusively empirical method demands a high degree of intuitive ability in the practitioner. [P.W.Br./G.Mo.]

**Emulsion** A dispersion of one liquid in a second immiscible liquid. Since the majority of emulsions contain water as one of the phases, it is customary to classify emulsions into two types: the oil-in-water (O/W) type consisting of droplets of oil dispersed in water, and the water-in-oil (W/O) type in which the phases are reversed. The continuous liquid is referred to as the dispersion medium, and the liquid which is in the form of droplets is called the disperse phase.

A stable emulsion consisting of two pure liquids cannot be prepared; to achieve stability, a third component, an emulsifying agent must be present. Generally, the introduction of an emulsifying agent will lower the interfacial tension of the two phases. A large number of emulsifying agents are known; they can be classified broadly into several groups. The largest group is that of the soaps, detergents, and other compounds whose basic structure is a paraffin chain terminating in a polar group. Some solid powders can act as emulsifiers by being wetted more by one phase than by the other. Whichever phase shows the greater wetting power will become the dispersion medium. Many naturally occurring emulsions, such as milk or rubber latex, are stabilized by proteins. Egg yolk proteins stabilize mayonnaise and salad dressing. Certain hydrophilic colloids such as gum arabic or gelatin also stabilize water-in-oil emulsions by a similar mode of action. See INTERPHASE OF PHASES.

Emulsions may be prepared readily by shaking together the two liquids or by adding one phase drop by drop to the other phase with some form of agitation, such as irradiation by ultrasonic waves of high intensity. In industry, emulsification is accomplished by means of emulsifying machines.

The breaking of emulsions is necessary in many industrial operations, for example, in the separation of water-in-oil emulsions in the petroleum industry and in product recovery from emulsions produced by the steam distillation of organic liquids. Emulsions may be broken by (1) addition of multivalent ions of charge opposite to the emulsion droplet, (2) chemical action (addition of acids to emulsions stabilized by soaps), (3) freez-

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ing, (4) heating, (5) aging, (6) centrifuging, (7) application of high-potential alternating electric fields, and (8) treatment with ultrasonic waves of low intensity. See COLLOD; DETERGENT; SOAP

**Enamel** A type of paint usually formulated by the suspension of pigments in resin and having excellent flow and leveling properties. Early enamels cured to a hard, smooth film with high gloss that simulated porcelain enamel. Modern formulation techniques now make available semigloss enamel finishes comparable in sheen and texture to satin fabric and flat finishes, as well as the high-gloss materials, all of which level out free from brush marks and other surface irregularities. See PAINT. [C.R.M.; C.W.S.I.]

**Enantiomer** One of an isomeric pair of chemical compounds whose molecules are nonsuperimposable mirror images. One molecular configuration of such dissymmetric substances is capable of rotating plane-polarized light to the right, dextro or (+) form, while the mirror image rotates the light equally to the left, levo or (-) form. Each member of such a pair (optical isomers) possesses identical chemical and physical properties except for interaction with other dissymmetric systems, that is, other optically active substances or plane-polarized or circularly polarized light. See OPTICAL ACTIVITY. [W.R.V.]

**Enargite** A mineral having composition  $Cu_3AsS_4$ . In some places enargite is a valuable ore of copper. The mineral has perfect prismatic cleavage, metallic luster, and grayish-black color. The hardness is 3 on Mohs scale, and the specific gravity is 4.44. Enargite is one of the rarer copper ore minerals and it has been mined in Yugoslavia, Peru, the Philippines, and the United States at Butte, Montana, and Bingham Canyon, Utah. Probably the largest deposit is at Chuquicamata, Chile. [C.S.Hu.]

**Encalyptales** An order of the true mosses (subclass Bryidae) that grow in dull, dark tufts on soil or soil-covered rock, generally in calcareous areas. The Encalyptales consist of a single family and two genera, the better known being Encalypta, the extinguisher moss, so called because of its long calyptro of candlesnuffer form.

Encalyptales are characterized by broad, papillose leaves and erect capsules covered by very long calyptro. The stems are erect and simple or forked with folded, incurved leaves. Leaves are broadly acute to rounded and often abruptly short-pointed to hair-pointed with a strong midrib ending at or beyond the leaf tip. The sporophytes are terminal, with elongate setae, and erect, cylindric, and ribbed capsules. The operculum is long-rostrate, and the peristome variable in structure. The spores are often large and quite various in sculpturing. See BRYIDAE; BRYOPHYTA; BRYOPSIDA; POTTIALES. [H.C.]

**Encholaimoidea** A superfamily of the order Dorylaimida that contains a single family of nematodes of unknown feeding habits. They are commonly found in soil near plant roots. The cephalic sense organs are all on the lips and arranged in two circles: the innermost circle consists of six small circumoral papillae; the outer circle consists of six large and four small papillae. The amphids are pouchlike and have slitlike apertures. The stoma is armed with an axial spear (odontostyle plus odontophore) that has well-developed flanges. The anterior esophagus is elongate and slender and is followed by a

small pyriform bulb. The body cuticle is marked by widely spaced transverse and longitudinal annulations that give the body a platelike appearance. The females have only one posteriorly directed reflexed ovary with an anteriorly located vulva. The preanal supplements of the male are tuberculate. See DORYLAIMOIDEA; NEMATA. [A.R.M.]

**Endocardial fibroblastosis** A cardiomyopathy characterized by marked fibrous and elastic thickening of the endocardium (the lining of the heart wall) which extends into the immediately adjacent myocardium. It is an important cause of cardiac death in infants between the age of 1 and 2 years. Some are associated with congenital malformations of the heart or a major blood vessel. However, in most instances it occurs independently of other heart lesions. The etiology and pathogenesis of this lesion is completely unknown. As a result of the thickening of the endocardium, the efficiency of the contraction of the heart is markedly diminished, and congestive heart failure ensues. See HEART; HEART DISORDERS. [N.K.M.]

**Endocarditis** An inflammation of the lining of the heart or endocardium, which also includes the tissues which form the heart valves. The two main forms of endocarditis are bacterial and nonbacterial. In the former there is active infection on the surface of a valve. This is usually fatal within a period of a few months unless successfully treated. The most common cause of nonbacterial endocarditis is rheumatic fever, which is sometimes characterized by a slowly progressive scarring of a heart valve. After some years this may cause serious mechanical impairment of cardiac function, due either to narrowing (stenosis) or incompetence (regurgitation) at the valve orifice. See RHEUMATIC FEVER. [P.B.B.]

**Endocrine system (invertebrate)** The chemical integrating system in animals that lack a vertebral (spinal) column. An endocrine system consists of those glandular cells, tissues, and organs whose products (hormones) supplement the rapid, short-term coordinating functions of the nervous system. Almost all of the information about invertebrates pertains to the more highly evolved groups that will be discussed below, the annelids, echinoderms, mollusks, and most particularly two classes of arthropods, the insects and crustaceans. Several of the hormones in invertebrates are neurohormones, that is, they are produced by nerve cells. See NEUROSECRETION.

**Insects.** Increase in linear dimensions of an insect can only occur at periodic intervals when the restricting exoskeleton is shed during a process known as molting. Once an insect becomes an adult, it ceases to molt. The orderly sequence of molts that leads from the newly hatched insect to the adult is controlled by three hormones. The brain produces a neurohormone which stimulates a pair of glands in the prothorax, the prothoracic glands, causing release of the molting hormone, ecdysone. A third hormone, the juvenile hormone, produced by a pair of glands near the brain, functions during the juvenile molts to suppress the differentiation of adult tissues. Juvenile hormone permits growth but prevents maturation. See ECDYSONE.

Two neurohormones with antagonistic actions are involved in regulating the water content of insects. One, the diuretic hormone, promotes water loss by increasing the volume of fluid secreted into the Malpighian tubules, the excretory organs. The second, the antidiuretic hormone, acts to conserve water by causing the wall of the rectum to increase the volume of water resorbed from its lumen while lowering the excretion rate from the Malpighian tubules.

Bursicon, a protein neurohormone, is responsible for the tanning and hardening of the newly formed cuticle. During the development of some insects, a period of arrested development